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(54) Title: **SUNSCREEN AEROSOL COMPOSITION**

(57) Abstract: The present invention is a sunscreen composition in the form of an aerosol that foams. The composition contains a sunscreen agent, an emulsifier, a foam builder/stabilizer, a counterion, and a propellant. In addition, the ratio of the foam builder/stabilizer to counterion is about 1:4 to about 5:1.2 to ensure the foam quality and integrity.

## SUNSCREEN AEROSOL COMPOSITION

### BACKGROUND OF THE INVENTION

#### I. Field of the Invention

5           The present invention relates to sunscreens. More particularly, the present invention relates to sunscreen compositions dispensed in the form of an aerosol product that foams.

#### II. Description of the Prior Art

10           Sunscreen compositions are applied to the skin to protect the skin from the sun's ultraviolet rays that can lead to erythema, a reddening of the skin also known as sunburn. Sunlight or ultraviolet radiation in the UV-B range has a wavelength of 290nm to 320nm and is known to be the primary cause of sunburn. Ultraviolet rays at a wavelength of 320nm to 400nm,  
15           known as UV-A radiation, produces tanning of the skin. However, in the process of doing so, the UV-A rays can damage or harm the skin.

              Besides the immediate malady of sunburn, excessive sunlight exposure can lead to skin disorders. For instance, prolonged and constant  
20           exposure to the sun may lead to actinic keratoses and carcinomas. Another long-term effect is premature aging of the skin. This condition is characterized by skin that is wrinkled, cracked and has lost its elasticity.

              As stated above, sunscreens are typically formulated with the goal of  
25           inhibiting skin damage from the sun's rays. The sunscreen composition filters or blocks the harmful UV-A and UV-B rays that can damage and harm the skin. It is believed that sunscreen agents accomplish this by absorbing the UV-A and/or UV-B rays.

30           In general, sunscreen compositions are oil and water emulsions. In this system, the UV-absorbing compounds are typically incorporated into the oil phase.

Sunscreens may also include physical or inorganic metal oxides that block the sun's rays. Titanium dioxide and zinc oxide are commonly used for this purpose.

5 Consumers consider many factors when purchasing a sunscreen product. One of the most important considerations is the sun protection factor (SPF). This determines the amount of protection that the sunscreen composition provides over a given period of time. There are many to choose from and selection will be based upon the consumer's needs. The  
10 consumer also gives consideration to the substantivity of the product, that is how durable is the product after applying it over the skin. This effects how often the composition will need to be applied when the consumer is out in the sun. A third consideration is product feel and how well the product spreads over the skin. Typically, consumers want a product that  
15 feels smooth and silky and be applied in a smooth continuous film over the skin. Another factor is the shelf life of the product, which is determined by the chemical and physical stability of the sunscreen composition. In addition, product form will also play a part since there is a variety of choices such as lotions, gels, creams, sprays, and aerosols that are available.  
20 Form preference could ultimately determine whether the consumer decides to purchase the product.

The unique product forms can be appealing to many consumers who are looking for something different. Sunscreens that are made in the form  
25 of an aerosol are not commonplace, particularly, aerosols that deliver the product as a foam.

#### BRIEF SUMMARY OF THE INVENTION

It is an object of the present invention to provide a sunscreen  
30 composition that is dispensed as an aerosol product in the form of a foam.

It is also an object of the present invention to provide such a sunscreen composition that delivers superior foam quality.

It is another object of the present invention to provide such a sunscreen composition that is effective in protecting the skin against UV-A and UV-B rays.

- 5 It is still another object of the present invention to provide such a sunscreen composition that spreads uniformly over the skin.

To accomplish the foregoing objects and advantages, the present invention, in brief summary, is a sunscreen composition that is dispensed  
10 as an aerosol product. The composition contains a sunscreen agent, an emulsifier, a foam builder/stabilizer, a counterion, and a propellant. In a preferred embodiment, the sunscreen composition also contains an emollient, a humectant, a preservative/antioxidant, and water.

- 15 Furthermore, the ratio of the foam builder/stabilizer to counterion must be about 1:4 to about 5:1.2. More preferably, the ratio is about 1:1 to about 5:1.

#### DETAILED DESCRIPTION OF THE INVENTION

- 20 The present invention is a sunscreen composition in the form of an aerosol comprising a sunscreen agent, an emulsifier, a foam builder/stabilizer, a counterion, and a propellant.

#### Sunscreen agents

- 25 The sunscreen agents that can be used in the present invention must be capable of absorbing or blocking the harmful effects of ultraviolet radiation. In addition, they must be non-toxic and non-irritating when applied to the skin. Suitable sunscreen agents include, for example, para-aminobenzoic acid (PABA), benzophenone-1, benzophenone-2,  
30 benzophenone-3, benzophenone-4, benzophenone-6, benzophenone-8, benzophenone-12, methoxycinnamate, ethyl dihydroxypropyl-PABA, glyceryl PABA, homosalate, methyl anthranilate, octocrylene, octyl dimethyl PABA, octyl methoxycinnamate, octyl salicylate, PABA, 2-phenylbenzimidazole-5-sulphonic acid, triethanolamine salicylate, 3-(4-

methylbenzylidene)-camphor, red petrolatum, and mixtures thereof. The preferred sunscreen agents are octyl methoxycinnamate, octyl salicylate, benzophenone-3, and mixtures thereof.

5       The sunscreen agents may be present in an amount about 1 wt.% to about 40 wt.% of the total weight of the composition of the present invention. The total amount of sunscreen agents in the composition will depend upon the sun protection factor (SPF) desired. Normally, the higher the SPF, the greater the total amount of sunscreen agents. Preferably, the  
10       sunscreen agents are included at about 4 wt.% to about 30 wt.%.

#### Emulsifiers

      An emulsifier is an essential component of the present invention. An emulsifier enables two or more immiscible liquids to be combined  
15       homogeneously, while increasing the viscosity of the composition. Moreover, the emulsifier acts to stabilize the composition. Emulsifiers that may be used in the present invention include sorbitan oleate, sorbitan sesquioleate, sorbitan isostearate, sorbitan trioleate, polyglyceryl-3-diisostearate, polyglycerol esters of oleic/isostearic acid, polyglyceryl-6  
20       hexaricinolate, polyglyceryl-4-oleate, polyglyceryl-4 oleate/PEG-8 propylene glycol cocoate, oleamide DEA, sodium glyceryl oleate phosphate, hydrogenated vegetable glycerides phosphate and mixtures thereof.

25       Furthermore, one or more synthetic polymers may be used as an emulsifier. For example, PVP Eicosene copolymer, acrylates/C<sub>10</sub>-C<sub>30</sub> alkyl acrylate crosspolymer, acrylates/steareth-20 methacrylate copolymer, PEG-22/dodecyl glycol copolymer, PEG-45/dodecyl glycol copolymer, and mixtures thereof.

30

      The preferred emulsifiers are PVP Eicosene copolymer, acrylates/C<sub>10</sub>-C<sub>30</sub> alkyl acrylate crosspolymer, PEG-20 sorbitan isostearate, sorbitan isostearate, and mixtures thereof.

The one or more emulsifiers are present in a total amount about 0.01 wt.% to about 15 wt.% of the total weight of the composition of the present invention. Preferably, about 0.1 wt.% to about 3 wt.% of emulsifiers are used.

5

#### Foam Builder/Stabilizer

The composition of the present invention must include a foam builder/stabilizer. The preferred foam builder/stabilizer is cetyl phosphate, DEA cetyl phosphate, TEA myristate, TEA stearate, magnesium stearate, sodium stearate, potassium laurate, potassium ricinoleate, sodium cocoate, sodium tallowate, potassium castorate, sodium oleate, and mixtures thereof. The foam builder/stabilizer in an amount about 0.1 wt.% to about 5 wt.% must be added to the composition of the present invention. Preferably, the foam builder/stabilizer is present in an amount about 0.1 wt.% to about 3 wt.%.

15

#### Counterions

Counterions are in the composition of the present invention to neutralize components such as an emulsifier and a foam builders/stabilizer. Sodium hydroxide, potassium hydroxide, diethanolamine, triethanolamine, aminomethyl propanol, trisodium ethylenediaminetetraacetic acid, and mixtures thereof, are examples of suitable counterions used in the present invention. The preferred counterion is triethanolamine.

20

Counterion is present in an amount about 0.01 wt.% to about 8 wt.% in the composition of the present invention. Preferably, counterion is present in an amount about 1 wt.% to about 5 wt.%.

25

A critical feature of the present invention is the ratio of the foam builder/stabilizer to counterion. To ensure superior foam quality and integrity, the ratio must be about 1:4 to about 5:1.2. Preferably, the ratio is about 1:1 to about 5:1.

30

#### Propellant

The propellant must be capable of producing a sufficient pressure for expelling the composition from an aerosol container. Furthermore, the propellant must be non-irritating, non-toxic and compatible with the ingredients used in the composition. Suitable propellants are butane, isobutane, propane, dimethyl ether, dichlorodifluoromethane, tetrafluoromethane, dichlorotetrafluoroethane, chlorodifluoromethane, chlorodifluoroethane, difluoroethane, and mixtures thereof. The preferred propellant of the present invention is a blend of isobutane and propane, commonly known as A-46 propellant. Propellant is present in the range about 3 wt.% to about 15 wt.% of the present invention. Preferably, the propellant is about 5 wt.% to about 9 wt.%.

#### Water

The composition of the present invention optionally can have water. Water can be present in an amount up to about 80 wt.%, preferably, from 30 wt.% to 70 wt.% of water.

#### Emollients

The present composition may additionally contain one or more emollients. An emollient provides a softening or soothing effect on the skin surface and is generally considered safe for topical use. Emollients also help control the rate of evaporation and the tackiness of the composition. Preferred emollients include mineral oil, lanolin oil, coconut oil, cocoa butter, olive oil, aloe extracts, jojoba oils, castor oil, fatty acids such as oleic and stearic, fatty alcohols such as cetyl and hexadecyl (ENJAY), diisopropyl adipate, hydroxybenzoate esters, benzoic acid esters of C<sub>9</sub>-C<sub>15</sub> alcohols, isononyl iso-nonanoate, alkanes such as mineral oil, silicones such as dimethyl polysiloxane, ethers such as polyoxypropylene butyl ethers and polyoxypropylene cetyl ethers, and C<sub>12</sub>-C<sub>15</sub> alkyl benzoates, and mixtures thereof. The most preferred emollients are hydroxybenzoate esters, aloe vera, C<sub>12</sub>-C<sub>15</sub> alkyl benzoates, and mixtures thereof.

Emollient is present in an amount about 1 wt.% to about 20 wt.% of the total weight of the composition. The preferred amount of emollient is

about 2 wt.% to about 15 wt.%, and most preferably about 4 wt.% to about 10 wt.%.

#### Humectants

5        A moistening agent, such as a humectant, may be incorporated into the present invention. Suitable humectants include glycerin, polyethylene glycol, polypropylene glycol, sorbitol, PEG-4, and mixtures thereof.

10       One or more humectants are optionally present at about 0.5 wt.% to about 8 wt.% in the present invention. Preferably, about 1 wt.% to about 5 wt.% of humectants may be used.

#### Titanium dioxide

15       Optionally, titanium dioxide may be added to the composition of the present invention. This material is generally considered safe for topical use since it is physiologically inert and has a low degree of irritation and toxicity. It functions by reflecting and absorbing sunlight. In the present invention, the titanium dioxide is suspended throughout the composition.

20       The composition of the present invention may have about 0.5 wt.% to about 10 wt.% of titanium dioxide. Preferably, there is present about 1 wt.% to about 3 wt.% titanium dioxide.

#### Preservatives/Antioxidants

25       Optionally, preservatives/antioxidants may be in the present composition. Diazolidinyl urea, iodopropynyl butylcarbamate, vitamin E, vitamin E acetate, vitamin C, butylated hydroxytoluene, methylparaben, and mixtures thereof may be a preservative/antioxidant in the present composition.

30

One or more preservatives/antioxidants may be present in an amount about 0.01 wt.% to about 2 wt.% of the total weight of the present invention. Preferably, one or more preservatives/antioxidants are present in an amount about 0.1 wt.% to about 1 wt.%.



### Rheological Additives

The present invention may include a rheological additive, such as magnesium aluminum silicate, hydroxypropyl cellulose, carbomer, cellulose, guar gum, xanthan gum, bentonite, acrylate copolymers, and mixtures thereof. The rheological additive assists in building the viscosity of the present invention.

The rheological additive may optionally be present at about 0.05 wt.% to about 5 wt.% in the composition of the present invention. Preferably, about 0.1 wt.% to about 2 wt.% of rheological additives are present in the present composition.

### Optional Additives

The sunscreen composition of the present invention may also contain optional additives. For instance, a fragrance, colorant, plant extract, absorbent, waterproofing agent, and mixtures thereof may be included.

### Process

The process used to manufacture the present invention must be capable of forming a homogeneous composition that can be sprayed or dispensed from an aerosol can.

Typically, aerosol products are made by filling a concentrate into a can and then filling the can with propellant under vacuum conditions.

The concentrate of the present invention may be prepared by using techniques and methods well known in the art. In general, ingredients are incorporated by mixing and applying heat if necessary, until the concentrate is uniform and homogeneous. If necessary, the concentrate may be homogenized to ensure homogeneity.

The concentrate is then placed in an aerosol can which is later filled with propellant.

Having thus described the present invention with particular reference  
5 to preferred embodiments thereof, it will be apparent that various changes  
and modifications may be made therein without departing from the spirit  
and scope of the invention as defined in the appended claims.

**WHAT IS CLAIMED IS:**

1. A sunscreen composition comprising:
  - (a) a sunscreen agent;
  - 5 (b) an emulsifier;
  - (c) a foam builder/stabilizer;
  - (d) a counterion; and
  - (e) a propellant.
- 10 2. The composition of claim 1, wherein said ratio of foam builder/stabilizer to said counterion is about 1:4 to about 5:1.2.
3. The composition of claim 1, wherein said foam builder/stabilizer is selected from the group consisting of cetyl phosphate,  
15 DEA cetyl phosphate, sodium stearate, potassium ricinoleate, sodium tallowate, and mixtures thereof.
4. The composition of claim 1, wherein said foam builder/stabilizer is about 0.1 wt.% to about 5 wt.% of the total weight of the  
20 composition.
5. The composition of claim 1, wherein said counterion is selected from the group consisting of sodium hydroxide, potassium hydroxide, diethanolamine, triethanolamine, aminomethyl propanol,  
25 trisodium ethylenediaminetetraacetic acid, and mixtures thereof.
6. The composition of claim 1, wherein said counterion is about 0.01 wt.% to about 8 wt.% of the total weight of the composition.
- 30 7. The composition of claim 1, wherein said sunscreen agent is about 4 wt.% to about 30 wt.% of the total weight of the composition.

8. The composition of claim 7, wherein said sunscreen agent is selected from the group consisting of benzophenone-3, octyl methoxycinnamate, octyl salicylate, homosalate, and mixtures thereof.

5 9. The composition of claim 1, wherein said emulsifier is about 0.01 wt.% to about 15 wt.% of the total weight of the composition.

10 10. The composition of claim 9, wherein said emulsifier is selected from the group consisting of PVP Eicosene copolymer, sorbitan isostearate, acrylates/C<sub>10</sub>-C<sub>30</sub> alkyl acrylate crosspolymer, PEG-20 sorbitan isostearate, and mixtures thereof.

11. The composition of claim 1, wherein said propellant is a blend of isobutane and propane.

15

12. The composition of claim 1, further comprising water.

13. The composition of claim 1, further comprising an emollient.

20 14. The composition of claim 13, wherein said emollient is selected from the group consisting of hydroxybenzoate esters, C<sub>12</sub>-C<sub>15</sub> alkyl benzoates, aloe vera, and mixtures thereof.

25 15. The composition of claim 1, further comprising a humectant.

16. The composition of claim 15, wherein said humectant is PEG-4.

30 17. The composition of claim 1, further comprising titanium dioxide.

18. The composition of claim 1, further comprising a rheological additive.

19. The composition of claim 18, wherein said rheological additive is magnesium aluminum silicate.

20. The composition of claim 1, further comprising a  
5 preservative/antioxidant.

21. The composition of claim 20, wherein said  
preservative/antioxidant is selected from the group consisting of diazolidinyl  
urea, iodopropynyl butylcarbamate, vitamin E, vitamin E acetate, vitamin C,  
10 butylated hydroxytoluene, methylparaben, and mixtures thereof.

22. The composition of claim 1, further comprising optional  
ingredients selected from the group consisting of a fragrance, colorant,  
plant extract, absorbent, waterproofing agent, and mixtures thereof.

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US00/19459

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :A61K 7/42

US CL :424/59

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 424/59

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	EP 0,791,353 A1 ( SHISEIDO COMPANY LIMITED) 27 August 1999, see entire document.	1-22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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